

REMARKS

Claims 1-10 are pending in the application. Claims 1-5, 7, 9 and 10 are rejected. Claims 6 and 8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Specification

The Examiner asserts that the title of the invention is not descriptive.

Applicants herein change the title to, "Method of Manufacturing a Semiconductor Device Including a Low-Temperature Lower Electrode-Forming Step". Applicants submit that this new title is sufficiently descriptive.

Claim Rejections - 35 U.S.C. §103(a)

Claims 1-5, 7 and 9-10 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,300,654 to Corvasce et al. in combination with Ohwaki et al., "Preferred Orientation in Ti Film Sputter-Deposited on SiO₂ Glass: The Role of Water Chemisorption on the Substrate", Jpn. J. Appl. Phys., Vol. 36 (1997) pp L154-L157 (provided by Applicant) and U.S. Patent No. 6,716,749 to Noguchi et al.

The Examiner admits that Corvasce et al. does not disclose keeping substrate temperature higher than room temperature and lower than 300 °C while forming a lower layer 26 of a lower-electrode conductive film on the insulating film 24.

The Examiner concludes that it would have been obvious to provide the conditions of Ohwaki et al. to the method of Corvasce et al. because the conditions of Ohwaki et al. would provide the ferroelectric capacitor of Corvasce et al. with the Ti (002) preferred orientation for the reliability of the electrode. With respect to claim 9, the Examiner asserts that it would have been obvious to provide the process of the combination with NH₃ plasma nitridation before lower layer of the lower-electrode conductive film is formed because the plasma nitridation would improve the surface of the insulating film as taught by Noguchi et al.

Applicants respectfully disagree with this rejection because not all of the claimed limitations are met by the cited combination of references.

Applicants note that in order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Finally, there must be a reasonable expectation of success. (Manual of Patent Examining Procedure §2142). The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure.

Applicants note that the claimed limitation of "keeping substrate temperature ...lower than 300 °C while forming a lower layer 26 of a lower-electrode conductive film on the insulating film 24" is not disclosed in the cited combination of references. Applicants note that Ohwaki et al. discloses a method of improving the orientation of a Ti film in the (002) direction

by heating a substrate to 350 °C and adding H₂O to a sputtering atmosphere of Ti. Ohwaki teaches that the water improves the orientation in the (002) direction, not any variation in temperature. Therefore, while there is a direct teaching and suggestion to vary the atmospheric water content during the sputtering, there is no suggestion for a method of forming the layer while not adding water to the sputtering atmosphere.

The Examiner asserts that the choice of temperature would have been a matter of routine optimization, and that one would have been led to the recited temperature of “higher than room temperature and lower than 300 °C” through routine experimentation to achieve desired deposition and reaction rates. However, for this assertion to be persuasive, there would still need to be a suggestion to optimize the temperature substantially in the direction of the claimed range. Applicants respectfully disagree that there is shown any suggestion to combine the references, and submit that even if the references were properly combined, there would have been no suggestion or teaching for all of the claimed limitations, because there is a direct teaching by Ohwaki et al. to maintain a minimum temperature of 350 °C while forming the lower electrode conductive film. Moreover, as the Examiner notes, there is no teaching of any particular temperature in Corvasce et al.

Given that the referenced prior art is directed to forming a (002)-oriented layer and describes that the deposition temperature of the Ti film is a minimum temperature of 350 °C, one skilled in the art would not have been directed to “experiment” with such a lower temperature.

Moreover, Applicants note that even if a prima facie case of obviousness were established by the Examiner, such a rejection would be rebutted by an appropriate showing of unexpectedly superior results associated with the claimed limitation. In this case, there is sufficient evidence to show unexpectedly superior results associated with the claimed temperature.

Applicants note that FIG. 2 is a graph showing the relationship between the deposition temperature of a Ti film and the degree of orientation of the Ti film in the (002) direction by XRD. Given that the referenced prior art is directed to forming a (002)-oriented layer and describes that the deposition temperature of the Ti film is a minimum temperature of 350 °C, it would have been unexpected that a temperature below 300 °C would provide a superior result.

Applicants therefore traverse the rejection.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

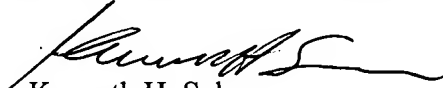
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Amendment under 37 C.F.R. §1.111
Amendment Filed: October 31, 2005

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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